

The telephone 13744

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The Telephone

About 100 years ago, Alexander Graham Bell invented the telephone by accident with his assistant Mr. Watson. Over many years, the modern version of

the telephone makes the one that Bell invented look like a piece of junk.

Developments in tone dialing, call tracing, music on hold, and electronic ringers have greatly changed the telephone.

This marvelous invention allows us to communicate with the entire globe

24 hours a day just by punching in a simple telephone number. It is the most used piece of electronic apparatus in the world. It is probably one of the most

easy to use electronics available too. All you have to do is pick up the receiver, listen for the tone, and then select a number using either tone or pulsing dial.

A telephone can be separated into two main categories: there is the tone (touch tone) or the older rotary dial (pulse) telephones. Then you can divide those into other categories such as business line (multi -- line) or home line (single line). You can also have many other types of phones: there are those

that hang on the wall, on the desk, etc.

THE HANDSET

No matter what kind of telephone you own, there has to be some device that allows you to talk to and listen to. This device is called the handset. The handset is usually made out of plastic and inside it are two main components:

the transmitter and the receiver.

THE TRANSMITTER

It is the job of the transmitter to turn the air pressure created by your sound waves to electrical signals so they can be sent to the other telephone. The waves hit a thin skin called the diaphragm that is physically connected to a reservoir of carbon granules. When the pressure hits the diaphragm, it shakes up the carbon granules. Then the carbon expands and contracts, depending on what force is exerted. At two points on the outer shell of the reservoir of the carbon are two outlets of electricity from the talk battery. By applying voltage, a current is made and is passed along the lines to

the waiting telephone. At the other end the current is transformed back to speech.

THE RECEIVER

The receiver turns an ever varying current back to speech. A permanently magnetized soft iron core is covered in many turns of very fine wire. Through the wire, the electrical current is applied. The currents attract and repel an iron diaphragm. By the vibrating actions the diaphragm does, a different pressure is created and these pressures are translated by ear into intelligible speech.

TELEPHONE NETWORKS

If you have ever opened up a phone (do not try this at home, you might screw it up) you will probably see a PC (printed circuit) board. The board contains the needed electronics for the phone to work properly. In older models of a working telephone, this board may look like an electronic box. This board is called the telephone network.

The telephone network's function is to provide all the necessary

components and termination points (screw on or push on terminals). The components and the termination points connect and match the impedance of a

handset (transmitter and receiver) to a two -- wire telephone circuit.

Every component in the telephone has to be connected to the PC board.

Usually, the board is the most reliable component inside the phone. All the delicate components are securely sealed by a metal enclosure. The PC board is a

very fragile object and can be broken easily. If you look closely, you can see wires poking out of the board. The wires are soldered to the terminal legs. If you break one of those wires, man are you dead!

TELEPHONE HOOK SWITCH

Every time you talk over a line, you always need to disconnect. The most simple thing to do is to let the handset sit down. While sitting down, the handset can give force to a spring loaded operating arm, which is connected to a

number of switch contacts. When this happens, the phone disconnects.

THE PHONE RINGER

Once a call has been dialed through, the telephone of the person being called must be given some kind of signal to let him/her know that he/she has been called. This is when the telephone rings. This type of signal is generated

using an alternating current somewhere between 90 to 220 V with a frequency of

30 Hz.

But what if you have 5 or 6 phones connected on a party line? How can you signal one telephone to ring? The answer is by frequency selection.

Older

telephones had a different capacitor and ringer coil impedance values. It was these small differences that made the bell select one frequency.

For example, if you have 5 telephones on one party line. If a call came through for line 1, the central board would send 10 Hz (this is a guess) signal to the party line. Line 1 would ring and all the others would remain quiet. If the call was for line 5, the central board would send a 50 Hz (this is also a guess) signal so that only line 5 would ring.

The phone rings by applying voltage where needed, a resonant circuit is

made. The xx Hz signal would make a magnetic field around a device called the

hammer. The hammer is attracted and then repelled by the constant changing of

the magnetic field. If two gongs were placed on either side of the hammer, the

hammer would strike each gong successively.

Other phones can use a one gong system. This system is like the two gong system, but more compact. Due to the compact in size, this ringer is perfect for

small wall phones or such.

THE ROTARY DIAL (PULSE)

A rotary dial creates equally spaced make -- and -- break pulses

according to how far the plastic dialing plate goes. A good description of a

dialing plate is like this: it has regularly spaced holes to dial with and a

metal object called the finger stop. That makes the number you want to go to as

easy as 1-2-3. Each hole in the wheel represents one number 1 through to 10.

By using some small gears and a device that times the velocity of the return of the finger wheel after you have dialed, the internal switches are opened and closed at a rate of 1 pulse per second. The number of pulses created

is determined by how far the finger wheel has gone around before being stopped

by the finger stop. Let's say that you dial the number 5, that means the internal switches open and close 5 times before the finger stop stops it.

During the dial, a second set of switches remain closed and stay that way for the entire time that you are dialing. The purpose for this second set of

switches is to keep the telephone receiver short for the whole dialing period.

If this switch was not there, you would hear loud and frustrating clicks in the receiver.

TONE DIALING

There is also an alternative to the pulse dial, that is the tone dial.

Phones that use tone dialing are made with a piece of machinery that makes tones

on the phone line. These tones are transformed by the central board into numbers.

The act of putting an audio signal on the telephone line as a dialing

utility is called the DTMF (dual tone multi -- frequency) dialing. It is called

this because the tone dial makes a combination of two tones. These audio signals

are made by a mixture of both high and low frequencies. When a button on the

dial pad is pushed, vertical and horizontal tones are combined to make a signal.

It is this newly made tone that is sent down the central board and then transformed back to the number.

TELEPHONE CORDS

Older telephone lines were made of fork shaped piece of metal attached

to wires with a tool called the crimper. When installed, these wires were

screwed into the terminal box on the wall. This is really a pain in the rear end

because if you are going to fix the phone, you have to unscrew the box, then all

the screws. This process could last for hours at a time.

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To make this job a lot easier, coiled cords and modular lines were invented. To take out the handset or telephone, all you have to do is to unplug

the modular connector from its match and that is it. Modular cords can be bought

nearly in any electronics store.

There are three kinds of cords. One is the full modular cord. There are small modular clips on both ends of the cord. The second is the one mentioned in

the first paragraph, this is called the spade -- lug cord. The third one is called the 1/4 modular, this cord has one modular connector on one side and the

old fashioned spade -- lug end on the other. These 1/4 cords are not very common.

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